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## Gender Differences in Colon Cancer Treatment

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### Abstract

**Background**—Despite women suffering a disproportionate burden of colon cancer mortality, few studies have examined gender differences in evidence-based treatment, especially in poorer states like Alabama.

**Objective**—To describe colon cancer treatment in older patients diagnosed in Alabama by gender.

**Methods**—Colon cancer patients 65 years and older diagnosed in 2000–2002 were identified from the Alabama Statewide Cancer Registry ( $N = 1785$ ). Treatment was identified from Medicare claims for 1999–2003. Outcomes were (1) receipt of surgery and adjuvant 5-fluorouracil chemotherapy (5FU) and (2) 5FU treatment duration (0–4, 5–7, and >7 months). Generalized Estimating Equation (GEE) models were used to determine significant gender differences, adjusting for clustering at the reporting hospital level, and controlling for race, age, stage, comorbid conditions, census tract–level socioeconomic variables, and adverse chemotherapy effects (when analyzing 5FU duration).

**Results**—Overall, 93.9% of the patients received surgery. Of stage II–III patients undergoing surgery, 60.4% stage III and 25.6% stage II patients received 5FU. Compared with men, women were more likely to have surgery (95.5% vs. 92.2%,  $p = 0.003$ ), less likely to have 5FU (38.6% vs. 45.2%,  $p = 0.02$ ), and more likely to have 0–4 months of 5FU (32.9% vs. 24.9%,  $p = 0.05$ ). Gender differences were significant for having chemotherapy (adjusted odds ratio [aOR] 0.78, confidence interval [CI] 0.61–1.00,  $p = 0.049$ ), but not for having 0–4 months of 5FU when adjusting for adverse effects (aOR 1.36, CI 0.95–1.94,  $p = 0.09$ ).

**Conclusions**—In Alabama, some gender differences in stage-specific colon cancer treatment are worth further scrutiny.

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Author Disclosure Statement

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## Introduction

THE AMERICAN CANCER SOCIETY (ACS) estimates that there will be more than 140,000 new cases of colorectal cancer in 2012.<sup>1</sup> Although men are more likely to develop colorectal cancer, women suffer a disproportionate mortality burden from this disease, especially older and African American women.<sup>2–5</sup> About 70% of colorectal cancer cases are cases of colon cancer.<sup>1</sup> Adequate treatment of colon cancer is important to potentially cure and/or prolong survival; therefore, differences in treatment may explain differences in survival across patients' groups. Treatment guidelines recommend surgery followed by adjuvant chemotherapy as the standard of treatment for stage III colon cancer.<sup>6,7</sup> For stage II colon cancer, colectomy may be all that is required, except for adjuvant chemotherapy for patients with higher risk for recurrence. Standard chemotherapy for colon cancer at the time of this study was 5-fluorouracil (5FU)-based chemotherapy usually administered in six cycles of 21–28 days each.<sup>8</sup> In a large randomized controlled trial, patients who received 5FU-based adjuvant chemotherapy had a relative risk reduction of 40% for recurrence and of 33% for mortality.<sup>9</sup>

Several studies have investigated whether cancer patients receive recommended treatment for their disease presentation, mostly focusing on differences by race and age.<sup>10–15</sup> Fewer studies have addressed the colon cancer treatment differences in regard to gender.<sup>16</sup> To address this research gap, the objective of this study was to describe the treatment of colon cancer by gender in older patients diagnosed in Alabama. In particular, we investigated whether surgery and adjuvant chemotherapy were received and how long chemotherapy treatment lasted for Medicare beneficiaries diagnosed in a 4-year period from 2000 to 2003.

## Materials and Methods

The current analysis is part of a larger study to assess cancer-directed treatment in Medicare patients with breast, colorectal, lung, or prostate cancer. The study was approved by the institutional review boards of the University of Alabama at Birmingham and the Centers for Disease Control and Prevention.

A cohort of 3435 Alabama residents 65 years old and older diagnosed with colon cancer in the period from January 1, 2000, to December 31, 2002, was identified from the Alabama Statewide Cancer Registry (ASCR). ASCR is Alabama's population-based cancer registry which is supported by the Centers for Disease Control and Prevention's National Program of Cancer Registries. The data collected by the ASCR have been recognized as high quality by the North American Association of Central Cancer Registries with a designation of silver certification in 2003 for case completeness greater than 90%.<sup>17,18</sup>

We obtained 1999–2003 Medicare claims for inpatient, outpatient, and physician visits for the cohort described above. Thus, we had at least 1 year of claims data for the period before the cancer diagnosis to determine comorbid conditions, and for least 1 year of follow-up postdiagnosis to determine cancer treatment received. Because administrative claims (and, thus, the opportunity of examining treatment) are available only for beneficiaries in fee-for-service plans, we excluded 856 cases of beneficiaries who were not on fee-for-service plans.

Of the remaining 2579 colon cancer patients, we excluded those with histology types not consistent with colon cancer ( $N = 24$ ), not black or white ( $N = 21$ ), with stage IV ( $N = 300$ ), and stage 0 or missing ( $N = 449$ ). The final cohort consisted of 1785 Alabama beneficiaries with stage I–III colon cancer. Compared with these, the 1650 beneficiaries excluded from analysis were more likely to be black (25.8% vs. 15.7%,  $p < 0.0001$ ) and to be older than 75 years (58.2% vs. 53.5%,  $p = 0.005$ ).

### Colon cancer treatment

We identified surgery using the International Classification of Disease Ninth Revision (ICD-9) codes 45.7x, 45.8x, 48.4x, 48.5x, 48.6x, and 48.7x, and the Current Procedure Terminology (CPT)/Healthcare Common Procedure Coding System (HCPCS) codes 44140–44147, 44150–44156, 44160, 45110–45114, 45116, 45119–45121, 45123, 45160, and 45170. We identified chemotherapy using ICD-9 codes V58.1, V66.2, 99.25, 99.24, 99.28, and 00.10, and CPT/HCPCS codes J9190, 96400, 96405, 96406, 96408, 96410, 96412, 96414, 96420, 96422, 96423, 96425, 96440, 96445, 96450, 96520, 96530, 96542, 96545, and 96549. We searched for relevant codes in the period starting 2 months before the diagnosis date reported by ASCR and ending 1 year after that date. We considered the following outcomes:

1. Having surgery;
2. Having adjuvant chemotherapy (5FU) after surgery for those with stage II and III colon cancer; and
3. Duration of 5FU chemotherapy among those with stage II and III colon cancer who started this treatment after surgery.

Treatment duration was defined as the time from the first and last claim for that treatment. Similar to Neugut et al.,<sup>11</sup> we identified patients who received 0–4 months of chemotherapy (i.e., 120 days or less), 5–7 months (i.e., 121–210 days), and more than 7 months (i.e., 211 days or more). Furthermore, we identified adverse events in the year postdiagnosis that were potentially related to chemotherapy (infection or fever, neutropenia or thrombocytopenia, anemia or transfused red blood cells, nausea emesis or diarrhea, abnormal electrolytes, dehydration, malnutrition, constitutional symptoms or nonspecific complication of treatment, deep vein thrombosis and pulmonary embolism) or were found to be rarely associated with chemotherapy in clinical trials (fractures and dislocations, asthma and chronic obstructive pulmonary disease, renal failure, thyroid disorders, and headaches).<sup>19,20</sup>

We used Generalized Estimating Equation (GEE) models to determine whether there were significant differences by gender for having surgery and adjuvant chemotherapy and for having chemotherapy 0–4 months. The GEE models accounted for the clustering of patients within reporting hospitals. This statistical technique has been used in various cancer studies of treatment and outcomes to control for clustering, for example, at the patient, the physician, the reporting hospital, or the neighborhood level.<sup>21–30</sup> All analyses were done using SAS (SAS software, version 9.1; SAS Institute, Cary, NC) including PROC GENMOD with REPEATED option. Independent variables included race, age, stage, comorbidity index, rural–urban residence, and census tract socioeconomic status. In the

model predicting 5FU duration of 0–4 months, we included those side effects that had significantly different frequencies for men and women. We used the Charlson Comorbidity Index<sup>31</sup> to identify debilitating or serious diseases that may have hindered the probability of getting colon cancer treatment. To measure socioeconomic status we created binary indicators for living in census tracts with 35% or more of the population being black, 20% or more of the population living below the poverty line, and 45% or more of the population with a high school education or less. These cutoffs were based on the value of the 75th percentiles for these variables.

## Results

Of the 1785 colon cancer survivors in this study, 48.7% were male and 51.3% female, 84.3% were white and 15.7% were black, and 46.5% were 75 years old or older (Table 1). Cases were equally distributed across stage I to III disease, and about 70% had at least one comorbid condition. Approximately 25% died by the end of the follow-up period (2003) with less than 8% dying within 9 months of diagnosis. Men and women did not differ in many demographic and disease characteristics, except that women were younger than men (59.7% in 65- to 74-year-old group vs. 47% of men,  $p < 0.0001$ ). However, 17.4% of the women were black compared with 14% of the men ( $p = 0.05$ ), and 33.2% of the women had stage III disease versus 29.2% of the men ( $p = 0.09$ ).

Overall 93.9% of the colon cancer survivors received surgery and of them 33.9% had adjuvant chemotherapy (Table 2). Of the 1182 patients with stage II–III disease who received surgery, 45.1% received chemotherapy and 41.7% received 5FU. As expected, use of chemotherapy was higher for persons with stage III colon cancer (60.4%) than for patients with stage II (25.6%) (Table 2). Moreover, among the 492 stage II and III patients receiving 5FU-based adjuvant chemotherapy, the mean number of days on treatment was 150.2 (SD = 78.07), and 28.9% received 0–4 months of 5FU with no difference by disease stage (Table 2). Moreover, more than 70% had symptoms such as anemia, nausea, emesis, or diarrhea, and about half suffered from dehydration or infection and fever (Table 3).

Women were slightly more likely than men to have surgery (95.5% vs. 92.2%,  $p = 0.003$ ), and were less likely to have 5FU-based adjuvant chemotherapy (38.6% vs. 45.2%,  $p = 0.02$ ). Among those who received it, women were more likely than men to have 0–4 months (32.9% vs. 24.9%,  $p = 0.05$ ) and less likely to have 5–7 months of adjuvant chemotherapy (49.4% vs. 60.2%,  $p = 0.01$ ) (Table 2). Women were more likely than men to experience dehydration (63.8% vs. 47.8%,  $p = 0.0004$ ). They were also more likely to have symptoms or conditions unrelated to chemotherapy such as thyroid disorder (16.9% vs. 7.2%,  $p = 0.001$ ) and fractures or dislocation (8.6% vs. <4.4%,  $p = 0.02$ ). Other symptoms had similar frequencies for men and women (Table 3).

In the analyses adjusted for age, disease stage, existence of other comorbid conditions, and census tract socioeconomic variables, gender differences remained statistically significant except for surgery. Women had significantly lower odds of 5FU-based adjuvant chemotherapy (odds ratio [OR] 0.78, confidence interval [CI] 0.61–1.00,  $p = 0.049$ ; Table 4) and higher odds of receiving fewer than 120 days of treatment (OR 1.52, CI 1.07–2.15; not

shown). When controlling for side effects, however, the gender difference in receiving fewer than 120 days of 5FU was not significant (OR 1.36, CI 0.95–1.94,  $p = 0.09$ ; Table 4).

No differences in treatment were found between white and black cancer survivors. Moreover, while survivors 75 years old or older were less likely to receive chemotherapy (27.4% vs. 58.8%, OR 0.24, CI 0.19–0.31), no differences were found in the duration of 5FU by age (Tables 2 and 4). In addition, having higher stages of disease was associated with higher odds of having surgery and chemotherapy, and with no significant differences in the likelihood of having chemotherapy duration of 0–4 months (Table 4). Finally, census tract variables were not associated with treatment (Table 4).

## Discussion

Among colon cancer cases diagnosed in Alabama in 2000–2002, we found that most received surgery and almost 42% received adjuvant 5FU chemotherapy. Among those with stage II–III disease who started this therapy, almost 30% received 0–4 months and about 70% received treatment for a longer period. Chemotherapy was used more frequently in patients with stage III colon cancer (60.4%). We also found that women were significantly less likely to receive chemotherapy compared with men and more likely to have a shorter duration of treatment. This finding is of concern because adjuvant chemotherapy for colon cancer patients with stage II and III disease significantly improves outcomes.<sup>8,9</sup>

Our results concur with those of Paulson et al.<sup>16</sup> who found that among 30,975 Medicare beneficiaries with colon cancer patients diagnosed in SEER areas in 1996–2002, women with stage III disease were less likely to receive adjuvant chemotherapy after surgical resection than men (51.5% vs. 59.5%,  $p < 0.001$ ). However, Neugut et al.<sup>11</sup> did not find gender differences in duration of 5FU among older Medicare beneficiaries with stage III colon cancer diagnosed in 1995–1999. In an earlier time period (1992–1996), Dobie et al.<sup>15</sup> found that female Medicare beneficiaries with stage III colon cancer were significantly less likely to receive chemotherapy and were less likely to complete chemotherapy, defined as 5 months or more, compared with men. However, the gender disparity in completion of chemotherapy was not significant after adjusting for age, stage, comorbidities, hospital readmissions, and socioeconomic information.<sup>15</sup> We previously found similar gender differences in duration of chemotherapy among older persons diagnosed with rectal cancer in Alabama around the same time period (1999–2003).<sup>32</sup>

The fact that women were less likely to receive adjuvant chemotherapy and have shorter duration of treatment is concerning. Poor health and older age are often reasons for underutilization of cancer treatment.<sup>33,34</sup> However, compared with men, women were younger and they did not have more comorbid conditions in the year before the cancer diagnosis. However, they were more likely to have thyroid disorder or fractures possibly before starting chemotherapy. Thus, women may be more likely to have some conditions that indicate frailty, making physicians reluctant to prescribe chemotherapy. Other factors that affect underuse of cancer treatments are related to beliefs in treatment efficacy, concerns about side effects, the relation with physicians, the treatment preferences of the physicians, and several other reasons that we could not ascertain in this study and that may

vary by gender.<sup>34–37</sup> Furthermore, women were not more likely than men to come from disadvantaged neighborhoods, and thus may not have been more likely to refuse chemotherapy for economic reasons. Therefore, research into reasons why chemotherapy use in women is low warrants further research.

Once chemotherapy is started, it is important to consider the impact adverse events may have on its duration. Schrag et al.<sup>14</sup> found that between 7% and 13% of colon cancer patients 65 years and older receiving chemotherapy were hospitalized for treatment-related adverse events such as neutropenia, mucositis, diarrhea, sepsis, and dehydration. Cen et al.<sup>20</sup> also reported high rates of chemotherapy-associated adverse events among Medicare beneficiaries with colon and rectal cancer in 2003 to 2005, especially for patients older than 70 years. All of these symptoms may cause a patient to prematurely stop treatment, leading to suboptimal outcomes. While some have reported that chemotherapy may be less tolerated in women,<sup>38–40</sup> Cen et al.<sup>20</sup> did not report differences in side effects by gender. Our findings, instead, showed that some side effects are more prevalent in women (e.g., dehydration) and that these may account for women having shorter courses of treatment. However, we have to consider that our findings are limited by a small sample size; investigating such gender differences in larger cohorts of colon cancer patients is thus warranted. The higher occurrence of some side effects in older women raises important questions about the administration of chemotherapy; for example, whether women are more likely than men to receive treatment doses not appropriate for their weight. Our claims data do not allow us to investigate whether this was the case, but future studies should investigate such potential differences in chemotherapy administration by gender.

Compared with previous studies of Medicare beneficiaries with colon cancer, Alabama beneficiaries received more adjuvant 5FU chemotherapy after surgery during the study period. For example, we found that among stage III colon cancer patients almost 64% had claims for chemotherapy. Neugut et al.<sup>11</sup> found that 54% of stage III colon cancer patients diagnosed in 1995–1996 received adjuvant chemotherapy. Similarly Dobie et al.<sup>15</sup> found that 55% of stage III colon cancer Medicare beneficiaries started chemotherapy. Similar rates were found by Paulson et al.<sup>16</sup> in the period 1996–2002. Hu et al.<sup>41</sup> for the period 1991–2005 found that 64.4% of Medicare beneficiaries received chemotherapy, and 62% completed it. Kahn et al.<sup>42</sup> found that among patients diagnosed in 2003–2005 in seven U.S. states including Alabama, 75% of those with stage III disease received chemotherapy. Among these patients, about 60% had more than 150 days of chemotherapy. We found similar patterns for rectal cancer patients in Alabama for the same time period: almost 65% of stage III rectal cancer patients had chemotherapy.<sup>32</sup> Duration of chemotherapy is also comparable to what was found in other studies. We found that only 26% of those with stage II–III disease had less than 4 months of chemotherapy, with about 55% receiving chemotherapy for 5–7 months. Others found among stage III colon cancer patients that 64%–78% had at least 5 months (150 days) of treatment.<sup>11,15,42</sup>

Other results of our analyses are of interest. We did not find racial differences in colon cancer treatment in this population. These findings concurred with Hofmann et al.<sup>12</sup> who reported no significant treatment differences among black and white colorectal cancer patients of all ages, and with Chagpar et al.<sup>13</sup> who found no difference in guideline



concordant care for colon cancer patients of all ages in the period 2003–2007. However, according to Dimou et al.,<sup>10</sup> black patients were less likely than white patients to have surgical treatment for stage I cancer, although surgery is the recommended treatment for this stage. We also found differences by age in the use of chemotherapy, although we found no difference in duration of this treatment. This is similar to others,<sup>11,13,16</sup> although Neugut et al.<sup>11</sup> found that older patients also had shorter courses of chemotherapy. Schrag et al.<sup>14</sup> found that patients who were older were as likely to want chemotherapy as their younger counterparts, and suggested that underutilization of chemotherapy among older patients may not be medically justified. The literature further supports this suggestion. Another study found that not receiving chemotherapy due to patient refusal was the case for less than a third of patients, while advanced age and comorbid conditions were reasons for 11.4% and 21.6% of patients, respectively.<sup>43</sup> Other explanations for decreased utilization of chemotherapy in older patients included financial and geographic barriers to care, physician knowledge and attitudes, as well as patient preferences.<sup>14</sup>

This study has several limitations. Information on treatment is derived from claims data and not from medical records. Therefore, identification of procedures depends on accurate billing and coding. However, other studies have found, for example, that use of chemotherapy can be reliably identified from these databases.<sup>44</sup> In addition, with these data, we cannot identify dose reductions or discontinuation of treatment prescribed by the physician. Symptoms and conditions that may be related to chemotherapy were identified for a 1-year period after diagnosis, and we cannot ascertain whether they occurred after treatment was initiated. However, we found that they were significantly more common among persons who had received chemotherapy. Lastly, during the study period 5FU-based chemotherapy with leucovorin or levamisole was the standard of care for colon cancer. Currently, 5FU remains the backbone of colorectal cancer chemotherapy, but accompanying drugs include oxaliplatin and irinotecan. We expect, however, that results are relevant to the new standard chemotherapy combinations because the side effects we described as those associated with 5FU and not the other drugs.

In conclusion, in Alabama, one of the poorest states in the United States where medical resources are more limited than in richer states, colon cancer patients received treatment comparable to or better than patients in other US states. However, our findings indicate that oncology providers may need to be alert to individual patient characteristics, including gender, which might lead to premature discontinuation of chemotherapy. In particular, attention should be given to specific side effects of therapy that may be more prevalent in women and lead to shorter courses of 5FU-based chemotherapy. Suboptimal duration of chemotherapy affects colon cancer survival.<sup>8</sup> Some studies clearly show such gender mortality disparities in colon cancer patients,<sup>3</sup> and others find no disparities when adjusting for treatment received.<sup>16</sup> More work is needed to elucidate the role of chemotherapy in reported gender disparities of colon cancer outcomes.

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**Table 1**

Demographic and Clinical Characteristics of Colon Cancer Patients with Nonmetastatic Disease: Percentages and *p* Values for Bivariate Associations<sup>a</sup>

	<i>All</i> N = 1785	<i>Sex</i>		<i>p</i> <sup>b</sup>
		<i>Male</i> N = 870	<i>Female</i> N = 915	
Sex				
Male	48.7	—	—	
Female	51.3	—	—	
Race				0.05
White	84.3	86.0	82.6	
Black	15.7	14.0	17.4	
Age				< 0.0001
65–74 years	53.5	47.0	59.7	
75 years	46.5	53.0	40.3	
Stage				0.09
I	31.8	33.9	29.7	
II	37.0	36.9	37.0	
III	31.3	29.2	33.2	
Comorbidity index				0.22
0	30.7	32.1	29.4	
1	69.3	67.9	70.6	
Vital status				
Deceased at the end of follow-up (2003)	25.4	26.2	24.7	0.46
Deceased within 9 months from diagnosis	7.9	7.2	8.5	0.31
Census tract socioeconomic status				
Percent black 35%	26.2	24.2	28.0	0.07
Percent with less than high school 45%	29.5	30.9	28.1	0.19
Percent living below poverty line > 20%	24.3	22.5	25.9	0.10

<sup>a</sup> Data from the Alabama Statewide Cancer Registry and Medicare: Alabama 2000–2002.

<sup>b</sup> *p* value obtained using chi-squared tests.

Surgery and Adjuvant Chemotherapy for Colon Cancer Patients with Nonmetastatic Disease by Patient Characteristics, and *p* Values for Bivariate Associations<sup>a</sup>

**Table 2**

	<i>Surgery among 1785 stage I-III patients</i>				<i>SFU<sup>c</sup> chemotherapy among 1182 stage II-III patients with surgery</i>				<i>Months of chemotherapy among 492 stage II-III patients on SFU</i>							
	<i>%</i>		<i>p</i>		<i>%</i>		<i>p</i>		<i>0-4</i>		<i>5-7</i>		<i>%</i>		<i>%</i>	
	<i>stage I-III patients</i>		<i>stage II-III patients</i>		<i>stage I-III patients</i>		<i>stage II-III patients</i>		<i>stage I-III patients</i>		<i>stage II-III patients</i>		<i>stage I-III patients</i>		<i>stage II-III patients</i>	
All	93.9				41.7				28.9		54.9		16.3			
Sex			0.003				0.02				0.05		0.01		0.39	
Male	92.2				45.2				24.9		60.2		14.9			
Female	95.5				38.6				32.9		49.4		17.7			
Race			0.30				0.70				0.48		0.14		0.27	
White	94.1				41.5				29.5		53.4		17.1			
Black	92.5				42.9				25.6		62.2		<13 <sup>b</sup>			
Age			0.51				<0.0001				0.03		0.04		0.92	
65-74	93.5				58.8				25.6		58.2		16.1			
75	94.2				27.4				34.7		48.9		16.5			
Stage			<0.0001				<0.0001				0.12		0.86		0.10	
I	87.1				—				—		—		—			
II	96.4				25.6				33.3		54.3		12.3			
III	97.8				60.4				26.7		55.1		18.2			
Comorbidity index			0.01				<0.0001				0.56		0.60		1.00	
0	93.0				45.7				29.5		54.2		16.3			
I	96.0				33.0				26.8		56.9		16.3			
Census tract socioeconomic status																
Percent black population																
35%	93.8		0.91		43.7		0.39		28.9		59.9		0.16		11.3	0.06
< 35%	93.9				41.0				28.9		52.9		18.3			

	5FU <sup>c</sup> chemotherapy among 1182 stage II–III patients with surgery				Months of chemotherapy among 492 stage II–III patients on 5FU					
	Surgery among 1785 stage I–III patients		All		0–4		5–7		7	
	%	p	%	p	%	p	%	p	%	p
Percent population with less than high school										
45%	93.0	0.29	42.1	0.85	29.1	0.93	52.3	0.45	18.5	0.36
< 45%	94.3		41.5		28.7		56.0		15.2	
Percent population living below poverty line										
> 20%	94.0	0.92	46.5	0.05	32.1	0.32	57.7	0.44	10.2	0.02
20%	93.9		40.1		27.6		53.8		18.6	

<sup>a</sup>Data from the Alabama Statewide Cancer Registry and Medicare: Alabama 2000–2002. The *p* values were obtained using chi-squared tests.

<sup>b</sup>Omitted due to small numbers.

<sup>c</sup>Of all patients with adjuvant chemotherapy, 90.1% had 5FU chemotherapy based treatment. 5FU, 5-fluorouracil.

**Table 3**

Adverse Events in Patients with Stage II-III Colon Cancer on 5-Fluorouracil Chemotherapy

	<u>All</u>	<u>Sex</u>		<u>p<sup>a</sup></u>
		<i>Male</i>	<i>Female</i>	
	<b>n = 492</b>	<b>n = 249</b>	<b>n = 243</b>	
Chemotherapy related				
Infection or fever	45.9	45.0	46.9	0.66
Neutropenia or thrombocytopenia	14.2	12.4	16.0	0.25
Anemia or transfused packed red blood cells	77.6	74.3	81.1	0.07
Nausea, emesis, or diarrhea	72.8	69.1	76.5	0.063
Abnormal electrolytes, dehydration	55.7	47.8	63.8	0.0004
Malnutrition	29.1	27.7	30.4	0.50
Constitutional symptoms or nonspecific complication of treatment	46.5	47.0	46.1	0.84
DVT/PE	13.6	10.8	16.5	0.07
Chemotherapy unrelated (only rarely associated with chemotherapy use in trials)				
Fractures or dislocation	6.1	<4.4 <sup>b</sup>	8.6	0.02
Asthma or COPD	14.2	12.8	15.6	0.38
Renal failure	9.3	10.8	7.8	0.25
Thyroid disorders	12.0	7.2	16.9	0.001
Headache	7.5	8.0	7.0	0.66

<sup>a</sup>The *p* value was obtained using chi-squared tests.<sup>b</sup>Omitted due to small numbers.

DVT/PE, deep vein thrombosis/pulmonary embolism; COPD, chronic obstructive pulmonary disease.



**Table 4**

Adjusted Odds Ratios (95% Confidence Intervals) of Receiving Treatment for Patients With Nonmetastatic Colon Cancer<sup>a</sup>

	<i>Treatment</i>					
	<i>Surgery</i>		<i>5FU adjuvant chemotherapy (Stage II-III, N = 1182)</i>		<i>0–4 months of 5FU treatment N = 492</i>	
	<i>OR</i>	<i>CI</i>	<i>OR</i>	<i>CI</i>	<i>OR</i>	<i>CI</i>
Sex						
Female	1.54	1.00–2.39	<b>0.78</b>	<b>0.61–1.00<sup>b</sup></b>	1.36	0.95–1.94
Race						
Black	0.72	0.37–1.40	0.89	0.59–1.33	0.73	0.42–1.28
Age						
75+	0.95	0.66–1.36	<b>0.24</b>	<b>0.19–0.31</b>	1.43	0.97–2.11
Stage						
I	1.00	—	—	—	—	—
II	<b>3.76</b>	<b>2.26–6.26</b>	1.00	—	1.00	—
III	<b>5.93</b>	<b>3.53–9.98</b>	<b>5.06</b>	<b>3.46–7.39</b>	0.70	0.47–1.05
Comorbidity						
1	<b>1.68</b>	<b>1.04–2.71</b>	<b>0.59</b>	<b>0.46–0.76</b>	0.89	0.58–1.38
Census tract socioeconomic status						
Percent black 35%	1.02	0.55–1.90	0.91	0.63–1.31	0.84	0.45–1.58
Percent with less than high school 45%	0.77	0.52–1.13	0.97	0.70–1.35	0.85	0.55–1.31
Percent living below poverty line > 20%	1.08	0.59–1.94	1.39	0.95–2.04	1.59	0.96–2.64
Side effects						
Abnormal electrolytes, dehydration	—	—	—	—	<b>2.13</b>	<b>1.41–3.24</b>
Fractures, dislocation	—	—	—	—	0.48	0.19–1.22
Thyroid disorders	—	—	—	—	1.48	0.93–2.35

<sup>a</sup>Data from the Alabama Statewide Cancer Registry and Medicare: Alabama 2000–2002, Generalized Estimating Equation models. Adjusted ORs are derived from logistic models adjusted for all variables listed in the table. Bolded figures highlight a significant difference ( $p < 0.05$ ).

<sup>b</sup> $p = 0.049$ .

OR, odds ratio; CI, confidence interval.